REMARKS/ARGUMENTS

Reconsideration of this application in light of the above amendments and following comments is courteously solicited.

The invention as claimed in amended claim 1 is directed to a copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities, which has a hardness Hv of 80.2 to 103.1, wherein a proportion of an alpha phase is 90 vol% or more, and wherein an apparent content B' of zinc in said copper alloy is in the range of from 34 to 39 wt%, said apparent content B' of zinc being expressed by the following expression:

$$B' = [(B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4) / (A + B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4)] \times 100$$

wherein A denotes the content (wt%) of copper and B denotes the content (wt%) of zinc, t_1, t_2, t_3 and t_4 denoting zinc equivalents of tin, silicon, nickel and iron, respectively ($t_1 = 2.0$, $t_2 = 10.0$, $t_3 = -1.3$, $t_4 = 0.9$), and q_1, q_2, q_3 and q_4 denoting the contents (wt%) of tin, silicon, nickel and iron, respectively.

Such a copper alloy has an excellent corrosion cracking resistance and an excellent dezincing resistance while maintaining excellent characteristics of conventional brasses.

Such a copper alloy can be produced by a method for producing a copper alloy, the method comprising the steps of: preparing raw materials of a copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of

phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities; casting the raw materials to form an ingot; hot working said ingot; cold or hot working the hot worked ingot; annealing the cold or hot worked ingot at a temperature of 300 to 600°C for two minutes to five hours; and cooling the annealed ingot at a cooling rate of 0.2 to 10°C/sec.

In a copper alloy as claimed in previously amended claim 1, the content of copper is 58 to 62.8 wt%, the content of tin is 0.3 to 0.5 wt%, and the proportion of the alpha phase is 90 vol% or more. Therefore, copper alloys described in Examples 3-6, 13 and 14 of the specification are within the scope of the invention as claimed in amended claim 1, whereas copper alloys described in Examples 1, 2, 7-12 and 15-20 of the specification are beyond the scope thereof. Moreover, in a copper alloy as claimed in currently amended claim 1, the content of silicon is 0.03 to 0.5 wt% of silicon, and the hardness Hv thereof is in the range of from 80.2 to 103.1, as described in Examples 3-6, 13 and 14 of the specification.

Claims 1, 5 and 11 were rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent 4,294,629 to Szyszkowski et al. or U.S. 2002/0015657 to Dong. Also, Claims 1, 5 and 11 were rejected under U.S.C. §103 as being unpatentable over U.S. Patent 4,259,124 to Smith et al. in view of U.S. Patent 4,294,629 to Szyszkowski et al. or U.S. 2002/0015657 to Dong.

Szyszkowski discloses a brass essentially containing, in addition to copper, from 30 to 40 wt% of zinc and from 1.5 to 4.5 wt% of lead, up to 1.3 wt% of tin, and up to 0.01 wt% of silicon, which has mono-phase alpha or di-phase alpha plus beta.

However, Szyszkowski fails to disclose or suggest any copper alloy containing 0.03 to 0.5 wt% of silicon. Szyszkowski

also fails to disclose or suggest any copper alloy containing at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%.

That is, Szyszkowski fails to disclose or suggest any copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities.

In addition, Szyszkowski fails to disclose or suggest any copper alloy having the above composition, a hardness Hv of 80.2 to 103.1 and the proportion of the alpha phase of 90 vol% or more.

Moreover, Szyszkowski fails to disclose or suggest any copper alloy which has the above composition and the proportion of the alpha phase of 90 vol% or more, and wherein an apparent content B′ of zinc in said copper alloy is in the range of from 34 to 39 wt%, said apparent content B′ of zinc being expressed by the following expression:

$$B' = [(B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4) / (A + B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4)] \times 100$$

wherein A denotes the content (wt%) of copper and B denotes the content (wt%) of zinc, t_1, t_2, t_3 and t_4 denoting zinc equivalents of tin, silicon, nickel and iron, respectively ($t_1 = 2.0$, $t_2 = 10.0$, $t_3 = -1.3$, $t_4 = 0.9$), and q_1, q_2, q_3 and q_4 denoting the contents (wt%) of tin, silicon, nickel and iron, respectively.

Thus, Szyszkowski fails to disclose or suggest any copper alloy which has an excellent corrosion cracking resistance and

an excellent dezincing resistance while maintaining excellent characteristics of conventional brasses.

Therefore, it would not have been obvious to one having ordinary skill in the art at the time the invention was made to make the present invention on the basis of the teaching of Szyszkowski.

Dong discloses a copper-base alloy comprising 57 to 60 wt% of copper, 0.3 to 3 wt% of tin, 0.02 to 1.5 wt% of silicon, 0.5 to 3 wt% of lead, and any one of 0.02 to 0.2 wt% of phosphorus, 0.01 to 2 wt% of iron and 0.01 to 2 wt% of nickel.

However, Dong fails to disclose or suggest any copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities, the copper alloy having a hardness Hv of 80.2 to 103.1 and the proportion of the alpha phase of 90 vol% or more.

In addition, Dong fails to disclose or suggest any copper alloy which has the above composition and the proportion of the alpha phase of 90 vol% or more, and wherein an apparent content B′ of zinc in said copper alloy is in the range of from 34 to 39 wt%, said apparent content B′ of zinc being expressed by the following expression:

$$B' = [(B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4) / (A + B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4)] \times 100$$

wherein A denotes the content (wt%) of copper and B denotes the content (wt%) of zinc, t_1, t_2, t_3 and t_4 denoting zinc equivalents of tin, silicon, nickel and iron, respectively ($t_1 = 2.0$, $t_2 = 10.0$, $t_3 = -1.3$, $t_4 = 0.9$), and q_1, q_2, q_3 and q_4 denoting the

contents (wt%) of tin, silicon, nickel and iron, respectively.

Thus, Dong fails to disclose or suggest any copper alloy which has an excellent corrosion cracking resistance and an excellent dezincing resistance while maintaining excellent characteristics of conventional brasses.

Therefore, it would not have been obvious to one having ordinary skill in the art at the time the invention was made to make the present invention on the basis of the teaching of Dong.

Smith discloses an alloy consisting essentially of 0.1 to 2.0% by weight tin, 0.1 to 2.0% by weight silicon, 20 to 34% by weight zinc, and the balance copper, wherein the content of alpha-phase within the alloy is at least 90% by weight.

However, Smith fails to disclose or suggest any copper alloy containing at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth. Smith also fails to disclose or suggest any copper alloy containing at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%.

That is, Smith fails to disclose or suggest any copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities.

In addition, Smith fails to disclose or suggest any copper alloy having the above composition, a hardness Hv of 80.2 to 103.1 and the proportion of the alpha phase of 90 vol% or more.

Moreover, Smith fails to disclose or suggest any copper alloy which has the above composition and the proportion of the

alpha phase of 90 vol% or more, and wherein an apparent content B' of zinc in said copper alloy is in the range of from 34 to 39 wt%, said apparent content B' of zinc being expressed by the following expression:

$$B' = [(B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4) / (A + B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4)] \times 100$$

wherein A denotes the content (wt%) of copper and B denotes the content (wt%) of zinc, t_1, t_2, t_3 and t_4 denoting zinc equivalents of tin, silicon, nickel and iron, respectively ($t_1 = 2.0$, $t_2 = 10.0$, $t_3 = -1.3$, $t_4 = 0.9$), and q_1, q_2, q_3 and q_4 denoting the contents (wt%) of tin, silicon, nickel and iron, respectively.

Thus, Smith fails to disclose or suggest any copper alloy which has an excellent corrosion cracking resistance and an excellent dezincing resistance while maintaining excellent characteristics of conventional brasses.

Therefore, it would not have been obvious to one having ordinary skill in the art at the time the invention was made to make the present invention on the basis of the teaching of Smith in view of Szyszkowski or Dong.

Accordingly, it is believed that the amended claims patentably distinguish the invention from the prior art.

An earnest and thorough attempt has been made by the undersigned to resolve the outstanding issues in this case and place same in condition for allowance. If the Examiner has any questions or feels that a telephone or personal interview would be helpful in resolving any outstanding issues which remain in this application after consideration of this amendment, the Examiner is courteously invited to telephone the undersigned and the same would be gratefully appreciated.

It is submitted that the claims as amended herein patentably define over the art relied on by the Examiner and early allowance of same is courteously solicited.

If any fees are required in connection with this case, it is respectfully requested that they be charged to Deposit Account No. 02-0184.

Respectfully submitted,

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